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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/603,696	06/26/2003	Robert J. Mears	62605	2901
27975	7590	07/26/2004	EXAMINER	
ALLEN, DYER, DOPPELT, MILBRATH & GILCHRIST P.A. 1401 CITRUS CENTER 255 SOUTH ORANGE AVENUE P.O. BOX 3791 ORLANDO, FL 32802-3791			HU, SHOUXIANG	
			ART UNIT	PAPER NUMBER
			2811	

DATE MAILED: 07/26/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)
	10/603,696	MEARS ET AL.
	Examiner Shouxiang Hu	Art Unit 2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on \_\_\_\_.
- 2a) This action is FINAL.                    2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_ is/are allowed.
- 6) Claim(s) 1-25 is/are rejected.
- 7) Claim(s) \_\_\_\_ is/are objected to.
- 8) Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on \_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All    b) Some \* c) None of:
  1. Certified copies of the priority documents have been received.
  2. Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)	4) <input type="checkbox"/> Interview Summary (PTO-413)
2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)	Paper No(s)/Mail Date. ____.
3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date ____.	5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)
	6) <input type="checkbox"/> Other: ____.

## **DETAILED ACTION**

### ***Information Disclosure Statement***

1. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references, such as the one in Paragraph 0006, have been cited by the examiner on form PTO-892, they have not been considered.

### ***Claim Objections***

2. Claims 8, 11, 14, 20, 21 and 25 are objected to because of the following informalities and/or defects:

In claim 8, the term of "semiconductormaterial" is in error.

In claim 11 and 20, the term of "the base semiconductor" lacks sufficient antecedent basis in each of the claims.

In claim 14, the term of "said second layer of said semiconductor" should read as: --said second semiconductor layer--.

In claim 25, the term of "group of," should read as: --group of oxygen,--.

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1-25 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claims 1-25 recites the subject matters of an alternating semiconductor/non-semiconductor laminated superlattice semiconductor structure, wherein each of the semiconductor layers (such as silicon) has a thickness of less than eight atomic layers (Si), and/or that the semiconductor structure has an effective carrier mass less than half of that silicon. However, the instant disclosure lacks an adequate description regarding how such a superlattice semiconductor can be actually formed, as it naturally requires the re-establishment of epitaxial silicon atomic layers over the non-semiconductor atomic layer (such as oxygen or nitrogen or compound atomic layer), while it has been found difficult to do so in the art (as evidenced in prior art, such as Wang et al., US 6,376,337; see col. 11, lines 27-29).

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 23-25 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between

the elements. See MPEP § 2172.01. The omitted elements are: the semiconductor/non-semiconductor superlattice structure and/or the corresponding material set that are essential to the realization of the recited effective masses in the instant invention. The recited structure is not definitely defined by Just recited the indented effective mass, as the effective mass can be affected by various factors.

***Claim Rejections - 35 USC § 102***

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

- (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1-4, 6-16, and 18-21, insofar as being in compliance with 35 U.S.C 112 and as being best understood in view of the claim objections above, are rejected under 35 U.S.C. 102(b) as being anticipated by Tsu (US 5,216,262).

Tsu discloses a semiconductor structure (Figs. 2-5), comprising: first and second silicon layers; and oxygen comprised non-semiconductor layers, wherein each of semiconductor and non-semiconductor layers can be 1 to 4 monolayers (see col. 5, lines 1-7).

Regarding claims 1-12 and 20-22, it is noted that the oxygen comprised non-semiconductor layer in Tsu comprises at least one atomic layer of oxygen.

Regarding claims 11, 12, 20 and 22, it is noted that, with the non-semiconductor layers each being one monlayer thick, the semiconductor structure of Tsu naturally has conductive effective masses substantially less than that of silicon.

Regarding claim 7, silicon oxide can be regarded as a compound between silicon and oxygen.

Regarding claims 9, 10, 18 and 19, as shown in Figs. 2-5, the semiconductor and non-semiconductor layers in Tsu can be regarded as being first formed covering substantially the whole wafer, as Tsu does not discloses any use of a depositing mask to block the depositing those layers. And, the semiconductor and non-semiconductor layers used in the art for making FET devices, such as the one in Tsu, are commonly formed on the entire wafer first before patterning them into the desired shape.

9. Claims 1-4, 6, 8-16, 18-20, and 22-24, insofar as being in compliance with 35 U.S.C 112 and as being best understood in view of the claim objections above, are rejected or further rejected under 35 U.S.C. 102(a) as being anticipated by Luo (Luo et al., Chemical Design of Direct-Gap Light-Emitting Silicon, Physical Review Letters, Vol. 89, No. 7, August 22, 2002, pages 076802-1 to -4).

Luo discloses a semiconductor structure (similar to Fig. 1; also see the left column of page 076802-3), comprising: first and second silicon layers; and an oxygen comprised non-semiconductor monolayer, wherein each of semiconductor can be less than 8 monolayers.

Regarding claims 11, 12, 20 and 22-24, it is noted that, with the non-semiconductor layers each being one monolayer thick and the semiconductor conductor layers being less than 8 atomic layers, the structure of Luo naturally has conductive effective masses substantially less than that of silicon, and/or less than half of that for silicon as it has a structure and material set substantially same as the one of the instant invention.

***Claim Rejections - 35 USC § 103***

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 5 and 17, insofar as being in compliance with 35 U.S.C 112 and as being best understood in view of the claim objections above, are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsu.

The disclosure of Tsu is discussed as applied to claims 1-4, 6-16, and 18-21 above.

Tsu does not expressly disclose that the semiconductor and the non-semiconductor materials can also be respectively formed of GaAs and a nitrogen comprised material. However, GaAs is also an art-known semiconductor material with good or better semiconductor characteristics compared with that of silicon; and that

nitrogen is also an art-known element used in the art for forming a good or better barrier material.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the semiconductor structure of Tsu with the semiconductor and the non-semiconductor layers being respectively formed of GaAs and a nitrogen comprised material, so that a semiconductor structure with good or better semiconductor and/or barrier performances would be obtained.

12. Claims 23-25, insofar as being in compliance with 35 U.S.C 112 and as being best understood in view of the claim objections above, rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art ("AAPA").

AAPA discloses a semiconductor structure (see Paragraphs 0004-0006), comprises channel regions in a MOSFET device. As evidenced in AAPA, it is art-known than that low conductivity effect masses for the carries in the channel region is always desirable for achieving improved device performance.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the MOSFET device AAPA with the conductivity effect masses for the carries in the channel region being reduced through whatever means to less than half of that for silicon, so that a MOSFET device with improved device performance would be obtained.

Regarding claims 24 and 25, it is not that silicon is art-known semiconductor material for forming a MOSFET device and nitrogen is an art-known element for forming a nitrogen comprised barrier layer or insulating layer in the MOSFET device.

***Conclusion***

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Reference B is cited as being related to a Si/O superlattice structure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is 571-272-1654. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only.

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For more information about the PAIR system, see <http://pair-direct.uspto.gov>.

Should you have questions on access to the Private PAIR system, contact the

Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SH

July 21, 2004



SHOUXIANG HU  
PRIMARY EXAMINER